

1 1. (Original) A high speed, low cost, wide spectrum plant identifier apparatus adapted to
2 be mounted on a farm vehicle for selectively identifying plants within a field by species and for
3 selectively applying chemicals thereto for the purposes of reducing the chemical costs and the
4 excessive chemical application which may otherwise result in pollution problems, said apparatus
5 comprising:

6 a) a sensing device for receiving reflected light from a plant, said device including a
7 diffraction element for separating the reflected light into segments of different wavelengths and a
8 linear sensor array having elements positioned to receive the segments and to measure the
9 relative magnitude of such segments to define a wide spectral distribution of the plant;

10 b) a digital identifier connected to said sensing device and having a memory for
11 memorizing a spectral distribution of light representing a first plant species from the field, and
12 additional memory for receiving a spectral distributions of other plants from the field and
13 programmable logic circuitry;

14 c) said logic circuitry having a program to compare the reflected spectral distribution of
15 other plants with the memorized spectral distribution of the first species and to provide an output
16 indicating substantial similarity between the distributions for effecting selective application of
17 chemicals to the plants of the first species as the associated farm vehicle traverses a field.

1 2. (Original) An apparatus as recited in Claim 1 in which said identifier comprises a
2 Digital Signal Processor.

1 3. (Original) An apparatus as recited in Claim 1 in which said program includes the
2 routine of making a regression analysis to determine the similarity between a first plant species

3 and the other plants.

1 4. (Original). An apparatus as recited in Claim 1 in which the logic circuitry includes a
2 switch for modifying the degree of similarity to be detected between the spectral distributions.

1 5. (Currently amended). A low cost, high speed spectral sensing method for collecting
2 and wirelessly transmitting spectral information on the physical condition of an objects such as a
3 plant and animal tissue in need of early, ~~for~~ remote analysis of the condition of the objects, said
4 method comprising the steps of:

5 a) sensing the spectral distribution of a plurality of segments of wave lengths of light
6 reflected by the object in need of early analysis with a portable spectral apparatus;

7 b) electronically measuring the magnitude of the segments of the reflected wavelengths
8 to define a wide spectral distribution of light received from said object; and

9 c) wirelessly transmitting the spectral distribution to a remote readable electronic
10 memory to facilitate said remote analysis of the object.

1 6. (Currently amended). The method as recited in claim 5 which the portable spectral
2 apparatus has a target light means for aiming the apparatus at the object. ~~distribution is~~
3 ~~transmitted in an analog state.~~

1 7. (Previously presented). The method recited in Claim 5 in which the spectral
2 distribution is first converted to digital information prior to transmitting.

1 8. (Currently Amended). A high speed, low cost apparatus for selectively identifying
2 objects, including fluids and tissue, and their condition, from within a population; said
3 apparatus comprising:

4 a) a sensing device for receiving reflected light from a sample object from the
5 population, said device including a lens diffraction device for separating the reflected light
6 into a plurality of segments of wavelengths and for measuring the magnitude of the segments
7 of reflected light to define a spectral distribution;

8 b) a digital identifier connected to said sensing device and having a memory for
9 receiving and storing a spectral distribution of light representing the sample object from said
10 population;

11 c) said digital identifier also having a memory for receiving and storing sequential
12 spectral distributions from additional objects of the population;

13 d) said digital identifier having a low cost chip with logic circuitry specially
14 programmed to compare the subsequent spectral distribution with the memorized spectral
15 distribution and to provide an output indicating similarity between the distributions.

1 9. (Previously presented). An apparatus as recited in claim 8 in which said chip
2 comprises a digital signal processor.

1 10. (Previously presented). A low cost, digital identifier apparatus for identifying
2 similarities of spectral distributions of two objects, said apparatus comprising:

3 a) a micro controller;

4 b) said micro controller having electronic memory elements for receiving digital
5 signals reflecting a first wide spectral distribution of light segments reflected from an object;

6 c) electronic memory elements for receiving digital signals reflecting spectral
7 distribution of light segments from other objects; and

8 d) logic circuitry including memory containing instructions for a regression analysis
9 program for enabling said micro controller to compare the first spectral distribution of light
10 segments with the spectral distribution of another object and for generating an output signal
11 reflecting the results of said comparison.

1 11. (Previously presented). An identifier apparatus as recited in claim 10 in which said
2 micro controller and said logic circuitry comprise a Digital Signal Processor.

1 12. (Previously presented). In an apparatus as recited in claim 10 in which said micro
2 processor can be programmed to generate an output signal upon calculation of different
3 coefficients of correlation.

1 13. (Currently Amended). A low cost, high speed method for facilitating evaluation
2 of selected objects, said method comprising the steps of:

3 a) obtaining a spectral distribution of reflected light segments from at least one
4 sample object of a population and converting same to electronic memory;

5 b) sequentially generating a spectral distribution of additional objects of a population
6 and converting same to electronic memory;

7 c) comparing said spectral distribution of the additional objects with the distribution
8 of said sample object with a low cost electronic controller chip ~~having an arithmetic logic unit~~

9 programmed with at least one correlation algorithm and coupled to said memories to achieve
10 said low cost method and to produceing an output signal of the similarity of ~~when~~ said
11 distributions ~~are similar~~.

1 14. (Previously presented). A method as recited in claim 13 in which the coefficient of
2 correlation can be varied to provide an output signal for different degrees of similarity.

1 15. (Original). A method as recited in Claim 13 in which the degree of similarity
2 required to generate the output signal can be increased or decreased.

1 16. (Currently amended). A low cost, lightweight apparatus for accumulation and
2 wireless transmission of a wide spectral distribution of an object including tissue and fluids
3 for early analysis and detection of their condition, said apparatus comprising:

4 a) a sensor array means for accumulating a plurality of charges reflecting a wide
5 spectral color distribution of light wavelengths reflected by said object to be analyzed;

6 b) controller means for directing said plurality of charges reflecting said spectral color
7 distribution to a port for wireless transmission to a remote analytical device for early analysis
8 of the spectral distribution of light of said object to detect its physical condition.

1 17. (Original). An apparatus as recited in claim 17 in which an analog to digital
2 converter is interposed between said array and said transmittal device for transmitting said
3 distribution in digital form.

1 18. (Currently Amended). A lightweight, portable device for collecting spectral
2 information on agricultural plants in need of remote analysis and for electronically recording and
3 transmitting the information for remote analysis, said device comprising:

4 a) a housing having an opening for receiving reflected light from said agricultural plants
5 in need of said remote analysis,

6 b) a diffraction device for receiving said light and for diffracting said light into a
7 plurality of segments having different wavelengths,

8 c) an array means carried by the housing and aligned for receiving a plurality of spectral
9 segments of light having different wavelengths and to generate voltages whose magnitude
10 generally correlates to the intensity of said segments to define a spectral fingerprint; and,

11 d) a controller means associated with said array for transmitting, by segment, the spectral
12 fingerprint to an electronic memory for said analysis of the agricultural plant.

1 19. (Currently amended). An apparatus as recited in claim 18 in which said portable
2 device has a target light means for aiming the apparatus at the agricultural plant. ~~controller~~
3 ~~means includes a compliant RS-232 port.~~

1 20. (Previously presented). An apparatus as recited in claim 18 in which said
2 controller means comprises a digital signal processor.

1 21. (Currently amended). A low cost, lightweight, sensing method for obtaining
2 spectral information on the physical condition of plants and tissue for subsequent analysis of
3 their physical condition, comprising the steps of :

4 a) sensing the spectral distribution of a plurality of wave lengths of light by segment
5 reflected by the plants and tissue;

6 b) electronically measuring the magnitude of the segments of the reflected
7 wavelengths to define a spectrum distribution of light received from said plants and tissue;
8 and

9 c) wireless means for ~~storing and~~ transmitting the said spectral information to a
10 readable electronic memory for said subsequent analysis ~~and identification~~ of the physical
11 condition of said plants and tissue.

1 22. (Original). A method as recited in claim 21 in which said magnitude of the
2 segments of the reflected wavelengths is converted to digital format prior to its transmission.

1 23. (Currently amended). A method as recited in claim 21 in which said spectral
2 distribution is sensed by a portable spectral apparatus having a target light for aiming the
3 apparatus at the plant or tissue. is transmitted via an RS 232 port.

1 24. (Original). A method as recited in claim 21 in which said spectral distribution
2 comprises at least 3 data points.

1 25. (Currently amended). A low cost method for comparing selected objects, said
2 method comprising the steps of:

3 a) obtaining a spectral distribution of reflected light segments from at a representative
4 of a sample species of a population;

1 b) sequentially generating a spectral distribution of additional species of a population;
2 c) comparing said spectral distribution of the additional species with the distribution
3 of said representative with an electronic controller chip having an arithmetic logic unit
4 specially programmed with a comparative algorithm to obtain said low cost method and
5 producing an output signal when said distributions are substantially similar.

1 26. (Original). A method as recited in claim 24 in which said spectral distributions
2 comprises at least three data points.

1 27. (Original). A method as recited in claim 24 in which said spectral distributions
2 are compared by a mathematical algorithm.

1 28. (Previously presented). A low cost apparatus for selectively identifying objects,
2 including fluids and tissue, and their condition, from within a population; said apparatus
3 comprising:

4 a) a sensing device for receiving reflected light from objects of a population, said
5 device including a lens diffraction device for separating the reflected light into a plurality of
6 segments of wavelengths and for directing said segments upon an array for measuring the
7 magnitude of the segments of reflected light to define a spectral distribution;

8 b) a digital identifier connected to said sensing device and having a memory for
9 receiving and storing a spectral distribution of light representing a sample object from said
10 population;

11 c) said digital identifier also having a memory for receiving and storing sequential
12 spectral distributions from various objects of the population;

13 d) said digital identifier having logic circuitry programmed to compare the subsequent
14 spectral distribution with the memorized spectral distribution and to provide an output
15 indicating the results of the comparison of the distributions.

1 29. (Previously presented). An apparatus as recited in claim 28 in which said sensing
2 device is calibrated such that the same segments of diffracted light wavelengths are repeatedly
3 separated and diffracted upon substantially the same area of the array.

1 30. (Previously presented). An apparatus as recited in claim 28 in which said sensing
2 device is aligned such that at least one segment of wavelengths of light is always diffracted
3 upon the same area of the array.

1 31. (Previously presented). An apparatus as recited in claim 28 in which said spectral
2 distribution comprises at least three data points.

1 32. (Previously presented). An apparatus as recited in claim 28 in which said logic
2 circuitry comprises a digital signal processor.

1 33. (Currently Amended). A low cost sensing apparatus for obtaining a spectral
2 distribution of an object, including plants, tissue and fluids, said apparatus including;

3 a) a sensing unit for receiving reflected light and having a diffraction device for
4 separating the reflected light into segmented wave lengths;

5 b) a linear array mounted in the path of said diffracted light for receiving the
6 segmented wave lengths and for electronically measuring the magnitude of thereof; and

7 c) a target light means positioned adjacent the sensing unit for emitting light upon the
8 source of the reflected light for aiming the sensing unit at the object whose spectral
9 distribution is being sought.

1 34. (Previously presented). A sensing apparatus as recited in claim 33 in which said
2 target light is directed in the opposite direction of the reflected light.

1 35. (Currently amended). A wide spectrum image device comprising;

2 a) a housing receiving light from an object and having a diffraction device for
3 separating the light into segments of different wave lengths;

4 b) a linear array positioned adjacent said housing for receiving the separated
5 wavelength segments and for electronically recording the magnitude thereof as an image; and

6 c) an aiming device having a beam of light supported by the housing for pointing the
7 housing and array towards the object from which the light is to be reflected. ~~target area.~~

1 36. (Previously presented). A wide spectrum image device as recited in claim 35
2 which includes an electronic identifier receiving the electronically recorded image from the
3 array and for identifying at least one property of the object.

1 37. (Previously presented). A wide spectrum image device as recited in claim 36 in
2 which said identifier is comprises a digital signal processor that includes an A to D converter
3 for converting the magnitude of the separated wave lengths to digital information

1 38. (Previously presented). A wide spectrum image device as recited in claim 36 in
2 which said identifier is a micro processor programmed to run a regression analysis to
3 determine the similarity between a first image and a second image.

1 39. (Previously presented). An image apparatus for selectively identifying objects,
2 including fluids and tissue, and their condition, from within a population; said apparatus
3 comprising:

4 a) a sensing device for receiving reflected light from an object of a population, said
5 device including a diffraction element for separating the reflected light into a plurality of
6 segments of wavelengths and an array receiving said reflected light for measuring the
7 magnitude of the segments of reflected light to obtain a spectral distribution;

8 b) a digital identifier connected to said sensing device and having a memory for
9 receiving and storing a spectral distribution of light representing the sample object from said
10 population;

11 c) said digital identifier also having a memory for receiving and storing sequential
12 spectral distribution from an additional object of the population;

13 d) said digital identifier having logic circuitry programmed to compare the subsequent
14 spectral distribution of the object with the spectral distribution of the sample object and to
15 provide an output indicating similarity between the distributions; and

16 e) an aiming light source for generating a beam of light to focus the digital identifier
17 upon the desired target.

1 40. (Previously presented). An apparatus as recited in claim 39 in which said identifier
2 comprises a digital signal processor.

1 41. (Currently Amended). A low cost digital identifier apparatus for comparing
2 spectral distributions, said device comprising:

3 a) electronic memory elements for receiving signals reflecting a first spectral
4 distribution of reflected light segments;

5 b) electronic memory elements for receiving signals reflecting an additional spectral
6 distribution of reflected light segments; and

7 c) logic circuitry in which said low cost apparatus comprises a controller chip with an
8 arithmetic logic unit interconnected with said memory elements and containing an algorithm
9 for a regression analysis for comparing the first spectral distribution of light segments with
10 the additional spectral distribution of reflected light segments.

1 42. (Currently amended). A digital identifier apparatus as recited in claim 41 in
2 which said controller chip and said memory elements comprises a Digital Signal Processor.

1 43. (Currently amended). A digital identifier apparatus as recited in claim 41 ~~2~~ in
2 which the apparatus has means for changing the coefficient of correlation of said regression
3 algorithm comprises a regression analysis.

1 44. (Currently amended). A digital identifier apparatus as recited in claim 41 in
2 which the first spectral distribution is obtained from a data base logic algorithm ~~includes an~~
3 ~~output indicating the degree of similarity between the two distributions.~~

1 45. (Previously presented). A digital identifier apparatus as recited in claim 41 in
2 which the algorithm indicates the degree of dissimilarity between the two distributions.

1 46. (Cancelled).

1 47. (Previously presented). A low cost method for comparing selected objects, said
2 method comprising the steps of:

3 a) generating a spectral distribution of reflected light segments in binary form from a
4 first object;

5 b) sequentially generating a spectral distribution of reflected light segments in binary
6 form of an additional object;

7 c) electronically comparing said spectral distribution of the additional object with the
8 distribution of said first object using a low cost chip containing an arithmetic logic unit having
9 an algorithm.

1 48. (Previously presented). A method as recited in claim 47 in which said chip
2 comprises a micro controller and said algorithm includes a regression analysis.

1 49. (Previously presented). A method as recited in claim 47 in which said light
2 segments in numerical form are generated by directing said light upon an array whose output
3 is converted to a digital output for comparison.

1 50. (Previously presented). A method as recited in claim 47 in which said light
2 segments are directed upon said array by a lens.

1 51. (Previously presented). A low cost sensing device for objects, said device
2 comprising:

3 a) an array for receiving reflected light from objects and for generating a plurality of
4 signals indicating the intensity of the reflected light;

5 b) a comparator connected to said array for receiving signals from said array, said
6 comparator having a regression algorithm for comparing the signals from the object with
7 signals from a standard and for identifying the similarity between objects.

1 52. (Previously presented). A device as recited in claim 51 the correlation coefficient
2 of the regression analysis can be changed to ascertain different degrees of similarity between
3 the object and the standard.

1 53. (Previously presented). A device as recited in claim 51 the correlation coefficient
2 of the regression analysis can be changed by a manual switch to ascertain different degrees of
3 certainty of identification.

Remarks.